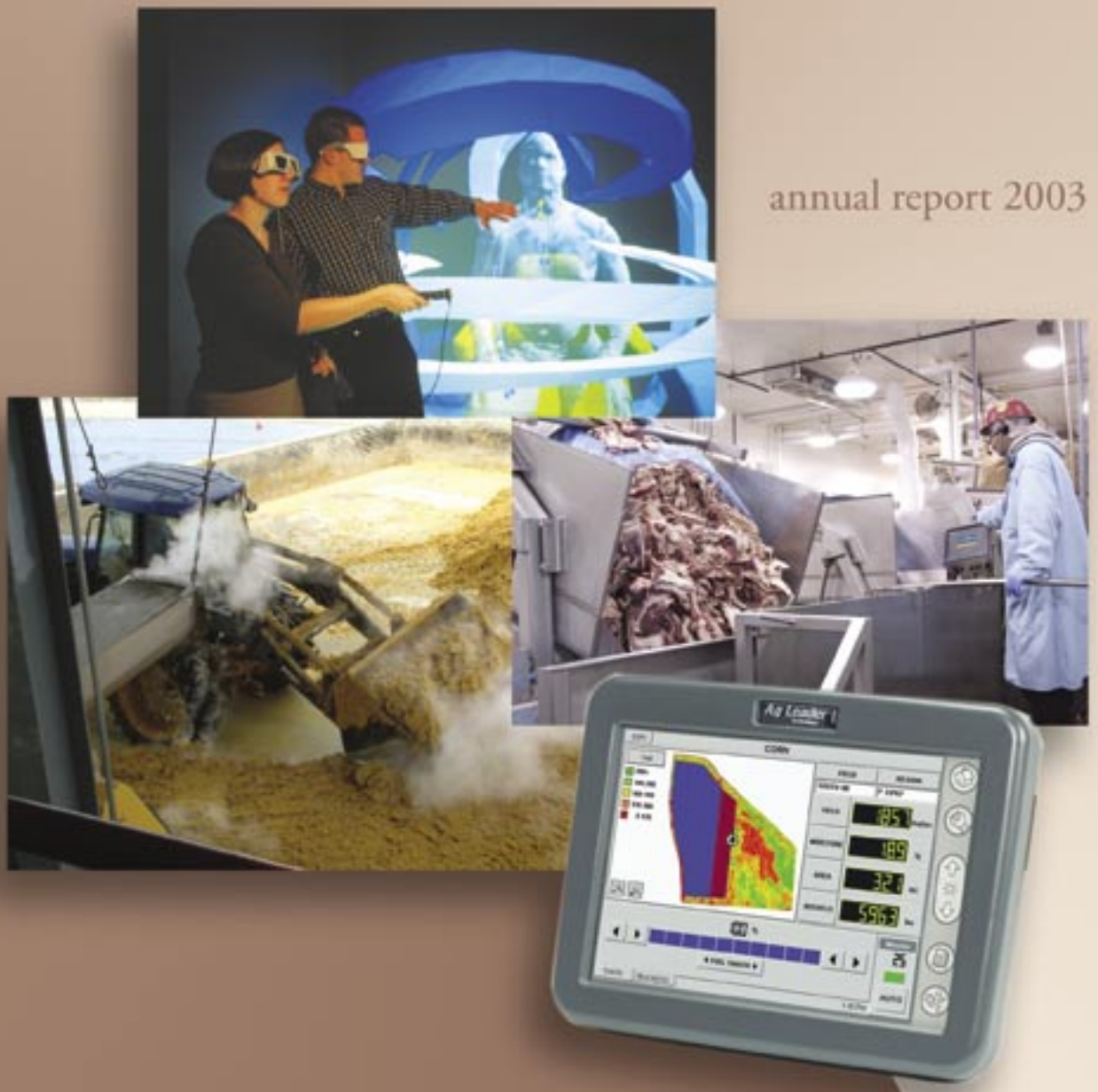
Institute for Physical Research and Technology

IPRT works for Iowa

annual report 2003



IOWA STATE UNIVERSITY

Institute for Physical Research and Technology

IPRT is a network of scientific research centers at Iowa State University. Through its company assistance efforts, IPRT also helps Iowa companies solve technical problems, create new products and increase productivity and quality.

RESEARCH CENTERS

Ames Laboratory of the U.S. Department of Energy
Conducts research into various areas of national concern, including energy resources, high-speed computer design, environmental cleanup and restoration, and the synthesis and study of new materials.

Center for Catalysis
Dedicated to the development of useful, practical catalysts and sustainable green chemistry methods. Its scientists investigate the application of catalysis and green chemistry methods to agricultural, industrial and environmental sciences.

Center for Nondestructive Evaluation
Develops noninvasive methods and instruments for assessing the integrity of structures and materials.

Center for Physical and Computational Mathematics
Researches high-performance computing via cluster computing and parallel-computing strategies.

Center for Sustainable Environmental Technologies
Develops and demonstrates renewable energy and chemical technologies and environmental technologies related to fossil fuels.

FAA Airworthiness Assurance Center of Excellence
Identifies and provides solutions for national aircraft-safety problems with a focus on inspection and maintenance issues.

Materials Preparation Center
Prepares high-purity metals, alloys and compounds in single and polycrystalline forms for research and engineering uses.

Microelectronics Research Center
Develops advanced materials, devices and process technologies in the fields of semiconductors, photonics and solar energy conversion and provides educational laboratories in these technologies for both undergraduate and graduate students.

Midwest Forensics Resource Center
Partners with local, state and federal agencies to address regional forensics needs for training, research, casework and education.

Virtual Reality Applications Center
Develops computer interfaces that integrate virtual environments, wireless networking, pervasive computing and third-generation user interface devices to amplify the creativity and productivity of people.

IPRT COMPANY ASSISTANCE

Leverages IPRT's world-class expertise and equipment to help Iowa manufacturers and entrepreneurs address specific research and development needs. IPRT Company Assistance provides technical assistance, contract research and development, start-up assistance and technology commercialization, and services to help Iowa small businesses win federal R&D funding.

EDUCATIONAL PROGRAMS

Science Bound
Works to increase the number of underrepresented students who pursue science and technology careers.

Contents

Cover images (top) courtesy of ISU Engineering Communications and Marketing, (bottom) Ag Leader Technology, Inc.

IPRT WORKS for Iowa

A good part of our mission at the Institute for Physical Research and Technology is to assist Iowa companies. Since 1987, we've been helping Iowa companies solve technical problems, create new products, and increase productivity and quality. Each year, we work with some 200 companies from all corners of the state, from one-person startups to Fortune 500 corporations.

We want to make it even easier, however, for Iowa businesses and entrepreneurs to access IPRT's services. As a result, we've reorganized these services, replacing an 'alphabet soup' of programs with a single cohesive unit called IPRT Company Assistance, which will provide a seamless system to serve Iowa companies and entrepreneurs.

IPRT's company assistance services include:

- Technical assistance in areas such as materials and nondestructive evaluation to help Iowa companies reduce costs, improve quality, boost productivity, and develop new technologies and products.
- Contract research for Iowa companies requiring long-term research and technical assistance projects to develop new products and markets, leverage internal R&D efforts, shorten product-development cycles and improve manufacturing.
- Services to assist start-up companies — from entrepreneurs to university faculty and students — to transform ideas into new or improved products or services and to help launch start-up companies.
- Training, mentoring and proposal preparation assistance to ease the proposal process and increase the chances of winning an award from the federal government's Small Business Innovation Research, or SBIR, and Small Business Technology Transfer, or STTR, funding programs.

The effort leverages the staff and resources from IPRT's former outreach programs, including the Center for Advanced Technology Development, the Iowa Demonstration Laboratory for Nondestructive Evaluation, the Iowa Companies Assistance Program, and the Iowa Industrial Incentive Program.

Our technical assistance and contract research services will not change, and Iowa companies will continue to have access to the expertise and facilities of IPRT's world-class research centers. We just want to make it easier and simpler to get you the help you need.

In this report, you can read about how we've helped Iowa companies, from promising new start-ups to established manufacturers. If we can be of service to your company, call us toll-free at (877) 251-6520 or email iprtinfo@iastate.edu. More details about IPRT Company Assistance can also be found on the Web at www.iprt.iastate.edu/assistance/.

Of course, research at our many scientific research centers remains strong, creating new technologies that benefit Iowa, the country and the world. You can read about some of these successful research projects as well as our educational efforts in this report.

Tom Barton
IPRT Director

Company Assistance

Shawn Kenny is an agricultural engineer with Ag Leader Technology, a top manufacturer of yield monitor systems for precision farming based in Ames, Iowa. Thanks to help from IPRT Company Assistance, the company was able to develop a cost-effective way to resolve a problem in a critical component in its yield monitor systems. Helping Iowa companies meet technical challenges is among the many ways IPRT works to develop Iowa's economy.

A Sound Inspection

A hydraulics cylinder manufacturer improves the quality and speed of its ultrasonic inspection process thanks to help from IPRT Company Assistance.

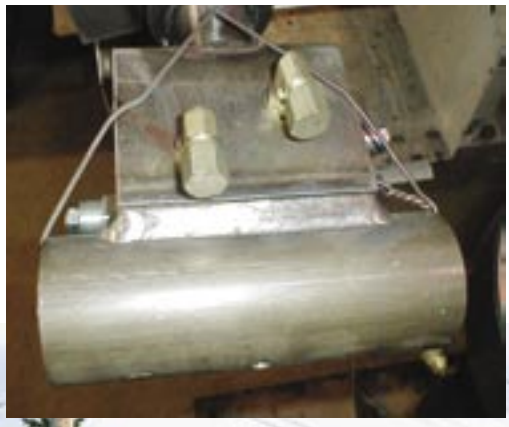
Bobalee Hydraulics is all about quality. The Laurens, Iowa, company is a leading maker of hydraulic cylinder assemblies for manufacturers in aerial personnel, construction, and utility equipment industries. Its ISO 9001:2000 certification represents the company's commitment to design and manufacture its products to meet customer specifications and quality goals. Now, working with scientists from IPRT Company Assistance, Bobalee has been able to further improve the quality of its products and yet reduce inspection time.

Ensuring "Clean" Steel

Bobalee makes components of its hydraulic cylinders from flat steel bars, about three inches wide and five inches tall and up to over 500 inches long, according to Jeff Redding, Quality Assurance Manager at the company. The intricate valve bodies in some of its hydraulic cylinders require that the bar stock has to be internally "clean," that is, free of microstructural flaws. If not, "catastrophic failure" would occur, says Redding, resulting in a lift that doesn't lift.

Bobalee first came to IPRT Company Assistance several years ago to learn about nondestructive testing methods that it could apply to its manufacturing processes. At that time, the company was catching leaks on its test stands after the hydraulic cylinders had been machined and assembled.

So, Redding worked with Dave Utrata, an IPRT Company Assistance scientist with expertise in nondestructive evaluation for manufacturing, to set up a way to use ultrasound to evaluate the bar stock prior to machining. Like the ultrasound methods used in medicine, the technology allowed Bobalee to "see" inside of bar stock to check for flaws without destroying the sample. The ultrasonic testing is primarily used for hydraulic cylinders made for aerial personnel applications.



With IPRT's assistance, Bobalee Hydraulics vastly improved the quality control process for components of hydraulic cylinders it manufacturers for applications such as aerial lift equipment.

Zero Defects

Over the years, ultrasonic testing had proved its worth to Bobalee. But, there was room for improvement. "We wanted to streamline our ultrasonic process and to validate the techniques we were using," Redding explains. "Dave is very knowledgeable about the subject as well as very committed to achieving results."

Utrata first visited Bobalee and evaluated its inspection process. Then, Redding and Utrata worked together to create a library of sample parts, with both organizations doing ultrasound scans and comparing results. Working units were made from these samples and tested for leaks to further validate the ultrasonic results.

The effort focused on creating an ultrasound testing process that was more accurate, reliable and efficient. As Utrata explains, "Too much 'inspection power' and you can detect things that really aren't of concern. Too little 'power' and you can miss real suspect targets."

After purchasing new equipment and implementing a new inspection process, the results speak for themselves, according to Redding. "We have had zero rejects and zero defects discovered beyond the ultrasonic testing," he says. "We are very satisfied." What's more, Bobalee has been able to reduce the time needed to inspect the steel bars. "It used to take up to 45 minutes to an hour to scan a 20-foot bar. Currently, it's taking 10 to 15 minutes," Redding reports. "That's our most recognizable financial benefit."

A Hot Tip

IPRT Company Assistance recommends a solution to cool down machining costs for a maker of agricultural monitoring systems.

In business, everything has a cost. Ag Leader Technology, Inc., a leading manufacturer of yield monitor systems for precision farming based in Ames, Iowa, faced this fact when it switched suppliers on a critical component and found that subsequent machining might greatly increase the part's cost. Thanks to an investigation by scientists at IPRT Company Assistance, however, a much less expensive solution was found and implemented.

Ag Leader Technology makes yield monitor systems that continuously shows data such as yield, moisture, combine speed, grain flow, and acres per hour on a display inside the combine. IPRT helped the company find a cost-effective way to resolve a problem with the manufacture of a critical component of this system.

Call the Metallurgists

A yield monitoring system mounts on a combine to continuously measure, log and display yield, moisture, acres and other parameters of the harvest. Ag Leader's products, the Yield Monitor 2000, the PF 3000, the PF 3000 Pro, and the PFadvantage, are the top selling yield monitors in the country. Shawn Kenny, agricultural engineer at Ag Leader, explains that an essential component in each product is the load cell. Placed in the clean grain elevator of a combine, the load cell measures the force of grain impacting it. This data is then used to determine the instantaneous yield during harvest.

The casting used as a frame for the load cell is basically a steel alloy block about four inches wide and six inches long. The part is cast at a foundry and shipped to a local machine shop where holes are drilled into it and the part is milled into its final shape.

Ag leader had been using some 2,500 of the parts annually since 1996. The possibility of extra costs arose when the foundry Ag Leader used went out of business and the parts had to be ordered from a new foundry. When castings from the new foundry arrived, however, the machine shop reported that drilling and milling tools were only lasting 50 to 70 percent of their expected life. The machine shop said that unless a solution could be found, it was going to have to pass along the extra cost of machining on to Ag Leader.

The machine shop didn't know what was causing the problem but had some advice: contact the scientists at IPRT Company Assistance. So, Kenny met with Paul Berge, an IPRT metallurgist and an expert in steel processing, to explain the problem and provide Berge with an old and a new casting to evaluate.

Grateful for the Work

Berge examined and compared the two castings using standard metallurgical practices. Using IPRT's battery of equipment, he studied the hardness, chemistry and microstructure of samples from each casting. Hardness and chemical composition turned out to be the same for both castings. But when Berge examined the samples' metallurgical structure (called a microstructure) at a microscopic scale of 100X, a difference emerged. "The two parts were distinctly different when we looked at the microstructures," Berge says. "When I got the samples under the microscope, it jumped right out."

The old casting had a microstructure that results from heat treatment, Berge explains. The microstructure of the new casting, however, had an "as-cast" structure, indicating it hadn't been heat treated. Berge researched the situation and confirmed that for this particular steel alloy, heat treatment would improve a casting's machinability without affecting its hardness or mechanical properties.

Berge suggested that Ag Leader have the parts heat treated, a process that costs significantly less than machining non-heat treated parts. "As a result of Paul's findings, we added a heat treating step at the casting supplier," Kenny said, adding that the process increased part costs by only 18 percent, versus a 54 percent increase in costs had the cause of problem not been found. "We're grateful for the work Paul did for us," he says.

Test But Don't Destroy

IPRT Company Assistance applies its knowledge of nondestructive evaluation to help an Iowa manufacturer avoid shipping defective parts.

Gits Manufacturing Co., a maker of original-equipment automotive components, prides itself on the quality of its products. So when the Creston, Iowa, company was having an assembly problem with an exhaust gas recirculation valve it makes for diesel engine manufacturers, it quickly sought help from IPRT Company Assistance.

"The project made a significant contribution. It's very costly if the parts are returned," says Neil Wohlenhaus, project engineer at Gits. "To date, we've been able to detect 239 fractured assemblies and take corrective action before shipment. This represents a cost savings of over $200,000."

IPRT Company Assistance applied its expertise in nondestructive evaluation to help Gits manufacturing pinpoint the cause of cracks in exhaust gas recirculation valves the company makes for diesel-engine manufacturers.

Fractured Shafts

The problem began when Gits changed the shaft material in the valve to a more wear-resistant, but more brittle, alloy. Some of the shafts began to fracture during assembly. So, Wohlenhaus and Don Sundberg, another Gits engineer, looked for ways to get more information about the shafts.

"We knew we needed some form of nondestructive testing," he says, referring to methods that can evaluate structures without having to destroy them. "But, as a medium-sized manufacturer, we don't have the specialists in-house that do nondestructive testing." As a result, Wohlenhaus and Sundberg paid a visit to Brian Larson, a scientist with IPRT Company Assistance and an expert in applying nondestructive evaluation, or NDE, to manufacturing.

Gits engineers believed their assembly workers were cracking the shaft when they pressed an interference-fit pin through the valve shaft, and they sought a nondestructive evaluation technique to test the assembled valves prior to shipment. Larson's team applied a nondestructive method, called through-transmission ultrasonic inspection, to test the shafts as they were being assembled. In this approach, ultrasonic pulses are directed through the test piece and detected on the opposite side. A decrease in the amount of sound energy transmitted through the component indicates the presence of a flaw. IPRT also loaned Gits ultrasonic equipment so testing could start immediately and not have to wait until the company could purchase its own equipment.

Getting to the Real Source of the Problem

However, the story doesn't end here. When Larson visited Gits' Creston plant to help implement the ultrasonic testing, he asked to see the process being used to inspect the new shafts when they arrive from suppliers. He found that Gits was using a visible dye penetrant inspection method, which is basically red dye in an oily solution that seeps into defects and "bleeds" back out after the excess penetrant is removed from the surface. A red spot on the surface provides a visible indication of a crack. Larson suggested a more sensitive penetrant inspection, in which the dye in the penetrant solution fluoresces under ultraviolet light to reveal smaller defects. This new inspection technique detected tiny cracks in nearly all the new shafts, leading to the conclusion that a faulty drilling process at the shaft supplier was the source of the problem. Gits assembly personnel were just propagating pre-existing cracks when they installed the pins in the shafts. Gits engineers were then able to work with their supplier to correct the real source of the problem.

The Strong, Silent Type

IPRT works with a start-up company to bring biomass-based materials to manufacturers in Iowa and beyond.

Creative Composites, Ltd. makes components from "biocomposites" that are stronger, quieter, lighter and less harmful to the environment than traditional materials such as fiberglass and steel. Made from a mix of natural fibers and traditional plastics, these unique products have applications ranging from office furniture to automobiles.

When the Brooklyn, Iowa, startup needed to ensure its products fit the needs of potential customers, it worked with IPRT Company Assistance. The effort gathered feedback from manufacturers and today, even though the company is not even two years old, it already has products in development with a number of major companies, most of which are in Iowa.

From Fiberglass to Natural Fiber

Craig Shore, president of Creative Composites, has a long history working with fiberglass. While fiberglass offered amazing versatility and strength, it was "terrible for the environment and hard to work with," Shore explains. When looking to start a new business, Shore discovered natural fiber-based composites. He began experimenting with the material and eventually founded Creative Composites in 2002 to make a business built on his discoveries.

Currently, Creative Composites purchases processed fiber mat from Indiana or Europe, but it hopes to purchase a fiber processing line. "This would allow us to use fiber from local producers — there is already a producers group formed in Brooklyn — as well as create proprietary fiber blends based on product requirements," Shore says. These mats are then formed into three-dimensional shapes using a thermoforming process, tapping special technology devised by Creative Composites. "Our strengths are in product development, materials engineering, processes and procedures," Shore says.

There from the Beginning

IPRT has been working with Creative Composites almost since its founding. Shore attended a biocomposites seminar given by IPRT in early 2002, where he met Carey Novak, an IPRT technology transfer associate. "His assistance has played a significant role in getting us where we are today," Shore says.

IPRT used the resources of the Technology Commercialization Acceleration Program, known as TCAP, to assist Creative Composites. TCAP provides research and engineering assistance, performs market and customer research, and supplies intellectual property services to Iowa entrepreneurs and businesses. It's a partnership between IPRT, the Iowa Department of Economic Development, the ISU Pappajohn Center for Entrepreneurship, the ISU Research Park and the ISU Research Foundation.

For Creative Composites, TCAP was used to set up interview sessions with large Iowa manufacturers. Novak conducted the interviews and then worked with Creative Composites to help the company focus and modify testing of applications of its technology.

"The contacts I've made through TCAP with various Iowa business people have directly led to new product development," Shore says. "The directed marketing provided by this program, not to mention the contacts with industry leaders, are exactly what a company like mine needs to get started."

Also through IPRT, Creative Composites has collaborated with several Iowa State University scientists. Adin Mann, a professor of mechanical engineering, consulted with the company on the sound-deadening properties of Creative Composites' materials. "We are optimistic that this will lead to future product development," Shore says. The company also has received advice from Doug Stokke, an ISU professor of forestry who specializes in wood science and biocomposites, and has used various testing facilities at the university.

Novak says the process of tapping established Iowa companies to provide feedback to startups is one that IPRT is using on other projects. "Because we have relationships with Iowa companies, it makes it easy for us to sit down with them and get their feedback," Novak says. The key step, Novak says, is making sure the start-up company uses the information. "It's that kind of hands-on product development implementation that brings the real benefits," he says.

Craig Shore of Creative Composites studies a sample of composites material made by his company inside an acoustics chamber in the lab of Adin Mann, a mechanical engineering professor at Iowa State University. IPRT helped company research the needs of large manufacturers and to fund research by Mann and his students.

Maintenance with Metallurgy

IPRT Company Assistance uses its expertise in metallurgy to help an Iowa food processor avoid an extensive recall and ensure its product quality.

You don't normally associate metallurgy with food, but in the case of an Iowa food processor, the combination has proved to be most beneficial. Burke Corp. manufactures and markets fully cooked meat products used as ingredients in other people's products, including restaurant pizza and frozen entrees and appetizers. The Nevada, Iowa, company came to metallurgists at IPRT Company Assistance to help identify a foreign object and came away with an innovative way to maintain its food processing systems.

Avoiding an Extensive Recall

Burke first came to IPRT Company Assistance when someone claimed to find glass in one of its products. "Of course, in our business, we view glass as very serious," explains Ross Jabaay, executive director of food safety and quality at Burke. The company has strict policies for tracking possible foreign objects in its products and keeps thorough maintenance records for just this reason.

"You must investigate these incidents as promptly as possible," Jabaay says. In this particular case, the object was clearly glass. In fact, Jabaay says, it looked like part of a "Drager" tube, an instrument used by Burke for environmental testing to ensure the safety of its workers. These tubes are used only by skilled technicians to determine the levels of carbon dioxide used in the chilling process. This 'Drager' tube is the only glass allowed in the processing areas.

Burke Corp. is working with IPRT to devise a novel maintenance system to improve the quality of the meat products the company manufactures.

But did the glass come from Burke's plant? That was the question Jabaay brought to Tom Lograsso, a metallurgist at IPRT Company Assistance. Jabaay gave both the found glass and a chip of glass from a Drager tube to Lograsso for an independent analysis. Working with Warren Straszheim at ISU's Materials Analysis Research Laboratory, or MARL, Lograsso determined that the foreign glass was chemically distinct from the Drager tube glass. Also, glass from the product appeared to have some type of plastic coating while the Drager tube did not.

Armed with this information, Burke was able to say that the glass did not come from its plant. "We feel comfortable in our own minds that it did not come from our process and this is backed up by the lack of other incidents or reports," Jabaay says. The effort also prevented "an extensive recall," according to Jabaay. At a minimum, that would have amounted to 150,000 pounds of meat.

An Excellent Resource

Having solved that mystery, Jabaay's thoughts turned to using the same kind of technology to help Burke further improve the quality of its meats. Like many food processors, Burke uses metal detectors to find minute pieces of metal in its products before they are shipped. Often, the metal is in the meat before it gets to Burke in the form of buckshot or other items. Sometimes, however, the metal is a piece from Burke's own equipment — resulting from normal wear on grinders or parts from freezer or oven belts.

Jabaay and Lograsso believed if they could devise a method to identify the composition of various metal pieces and then match them to their source, the company could perform additional predictive maintenance on its food processing equipment and set up processes to prevent the metal from getting into the product in the first place. This would take Burke's food safety program to a new level, well beyond anything done by the industry. With assistance from MARL, the two are now working together to analyze samples and construct a database to create a foreign object identification system.

Such a system does have some limitations, since analysis of metal can only determine its basic chemical composition. "Stainless steel is stainless steel," Lograsso explains, and could come from any number of sources. Still, the information can go a long way toward helping Burke track down the sources of metal. In fact, Jabaay is not aware of a similar system, and once the technology is fine-tuned, he hopes other food processors can benefit from it.

Jabaay says Burke is pleased with the service provided by IPRT. "IPRT provides an excellent resource for people to get help with solving problems they might not otherwise be able to solve."

Gathering Grants for Biotech Research

IPRT helps an Iowa biotech company garner five federal grants to research novel disease detection technologies.

Molecular Express is an up-and-coming biotech company that works to develop technology that will, among other things, make it possible to detect diseases such as cancer earlier than is currently possible. As with most biotech companies, Molecular Express needs funds to do its early-stage research. With assistance from IPRT, the company has been able to win competitive research grants through federal agencies such as the National Institutes of Health and the U.S. Department of Energy.

Growing Biotech in Iowa

The Ames, Iowa, company develops aptamer-based reagents for various applications, according to Marit Nilsen-Hamilton, company president and CEO and a professor of biochemistry, biophysics and molecular biology at Iowa State University. Most of the applications are in the medical field, where the reagents are used to detect changes in gene expression in patient samples and will eventually be used to detect tumors and other diseased tissues in the body and to deliver drugs to those tissues.

Nilsen-Hamilton explains that aptamers are nucleic acids that, like antibodies, recognize other molecules with specificity and high affinity. However, aptamers have advantages over antibodies in that they are smaller and can penetrate into tissues more easily. "Aptamers were only discovered within the past 15 years and are a relatively unexplored technology," Nilsen-Hamilton explains.

To help fund its basic research in aptamers, Molecular Express turned to the federal Small Business Innovation Research, or SBIR, program. Under this program, small businesses (those with 500 or fewer employees) can propose innovative R&D projects that meet specific needs of federal agencies and obtain funding to do the research.

"IPRT-sponsored workshops were very helpful," Nilsen-Hamilton says, adding that IPRT arranged for a consultant and an experienced SBIR grant writer to read and critique its first grant proposal. "Although we were not awarded that grant, the critique was very useful in helping to form future, more successful applications," Nilsen-Hamilton says. "IPRT has also helped us greatly with seed-funding to increase our chances of getting our technology to work within the time that we have under the grant funding."

Molecular Express has gone on to win five SBIR grants, including three in 2003, for a total of $880,000. "I suspect that our most direct benefit to the state of Iowa will be that we provide an option for talented college-trained young people to obtain jobs and remain in the State," Nilsen-Hamilton says. The company currently has nine employees, five of whom have advanced degrees. "We hope that, as we grow, we will contribute to the development of Iowa's biotechnology base," she adds.

Record 26 Awards Worth $6.4 Million

Molecular Express is only one of many companies IPRT has worked with on SBIR grants and the similar Small Business Technology Transfer, or STTR, grants. Overall, participation in the SBIR and STTR programs is an important national indicator of a state's competitiveness in technology-based economic development. Thanks in part to IPRT's efforts, Iowa's small, high-tech companies are succeeding in winning awards from a variety of agencies, including the Department of Defense, National Institutes of Health and NASA. In the last year, 18 Iowa companies won 26 awards worth $6.4 million, the most awards ever won in a single year and the highest dollar amount ever.

IPRT's SBIR/STTR assistance covers three areas:

- A matching service, which links company interests to federal agency solicitation topics. IPRT does about 200 matches each year.
- Proposal assistance, where IPRT associates guide companies and entrepreneurs in moving through the complex process of responding to federal RFPs. This includes assistance with planning proposals, developing strategies for technology development and commercialization, and reviewing and critiquing proposals. In addition, IPRT connects experienced SBIR/STTR awardees with new applicants through a mentoring network.
- Workshops where Iowa businesses learn about SBIR/STTR opportunities and how to develop competitive proposals. Attendance averages about 60 participants; many are among the successful awardees in the state each year. Attendees include new business startups, entrepreneurs, mentors, previous award winners and state economic developers.

Pierre Palo, Richard Hamilton and Marjan Mokhtarian (left to right) are scientists with Molecular Express, Inc., an Ames-based biotech company. IPRT worked with the company to help it obtain research grants.

Enhancing Food Naturally

IPRT Company Assistance works with an Iowa company to investigate a promising new, natural food enhancement.

As a pioneer in the development of natural preservatives for meat products, Kemin Americas, Inc. is always striving to learn more about these substances. A promising one is a natural liquid rosemary extract with enhanced effectiveness made with a proprietary process developed by the Des Moines company.

Kemin wanted to know more about the extract and sought an independent source to study it. That's where IPRT Company Assistance came in, setting up and helping to fund a project with an Iowa State University researcher to study rosemary extract as a potential replacement for the synthetic preservatives currently used in processed meats.

Putting It to the Test

Meat products spoil because of microbial growth or chemical deterioration. So, processed meats use preservatives to control component deterioration that leads to rancidity. Cured meats use sodium nitrite, while uncured meats typically depend on synthetic antioxidants known as butylated hydroxyanisole, commonly called BHA, and butylated hydroxytoluene, or BHT.

While these substances are very effective, some consumers worry about their health effects. Kemin is leading the charge to develop natural alternatives, and its rosemary extract is a promising candidate. "Because rosemary extract is a natural compound and enjoys a highly positive consumer image, it is of significant interest to the meat industry and expanded applications are very likely if effectiveness in meat systems can be demonstrated," explains Vince Sewalt, director of R&D at Kemin.

Vincent Sewalt (left) and Kristen Robbins (center) of Kemin Americas worked with Joe Sebranek, an Iowa State University professor, in the ISU Meat Lab to research a promising new food enhancer that Kemin is planning to market. The project was made possible through IPRT.

"We were looking for one of the premier researchers in the field of meat quality to do that work for us, and we found Joe Sebranek," says Sewalt. Sebranek is a professor of animal science as well as food science and human nutrition at ISU and a noted expert in meat processing. He is also housed in the ISU Meat Laboratory, where the research took place. This lab supports teaching, research and industry-education programs and pilot-plant assistance for meat and food companies. It is a U.S. Department of Agriculture-inspected facility for slaughter, cutting and sale of meat and meat products as well as further processing.

Kim Bentley, a technology transfer associate with IPRT Company Assistance, helped establish a collaborative project with Sewalt and Sebranek to do the research. IPRT also helped fund the first round of the study. According to Sebranek, Bentley assisted in initial discussions and provided support to keep the project moving. "Kim was instrumental in getting Kemin's commitment to the project," Sebranek says.

Sewalt and Sebranek worked together to devise a comprehensive study using raw-refrigerated, raw-frozen and cooked-frozen sausage. Pork sausage was chosen for a test product because it has a relatively short shelf life under normal circumstances, and traditional preservatives are critical to its shelf life. And, it's commercially marketed in the three different forms, providing a variety of environments in which to compare effectiveness.

The sausage was tested with a range of rosemary extract concentrations and compared with sausage containing BHA and BHT. "We've been pleased in collaborating with Joe," Sewalt says. " We used his strengths in food and meat science as well as all of the facilities at ISU."

Lead to Bigger Things

The study showed that Kemin's form of natural rosemary extract was very effective in color and freshness retention of pork sausage products, according to Sebranek. Kemin is using these results to educate the industry about the potential of rosemary extract. Sewalt says, "This work — the fact that we were able to produce data of high quality — has already opened the door to various sausage manufacturers and sausage-spice blend developers. I think it will lead to bigger things – thanks to IPRT and ISU."

World-Class Research

Ames Laboratory materials chemist and Iowa State University chemical engineer Surya Mallapragada inspects samples of special bio-compatible block polymers that have the ability to react like proteins. The polymers are sensitive to changes in pH and temperature and show promise as a means of delivering drugs, such as insulin, in a reliable manner based on changes in the body's chemistry. Such innovations are practically an everyday occurrence at IPRT's scientific research centers.

Polymers That Act Like Proteins

Ames Lab researchers are studying how self-assembling polymers can react like proteins to delivery drugs

A group of bioinspired polymers are being studied by researchers at Ames Laboratory to understand how they are able to form and react to stimuli similar to the way proteins react in nature. Unlocking how these soluble block polymers are able to self-assemble, could lead to a variety of uses such as controlled release systems for sustained and modulated delivery of drugs or gene therapies.

Ames Laboratory materials chemist Surya Mallapragada and her research team are focusing on pentablock polymers, polymers that form in strings of five chains. Each string is comprised of two cationic (positively charged) blocks, two hydrophilic (water loving) blocks, and one hydrophobic block. Because the hydrophobic block tries to avoid water, it forms the center of the string, with the hydrophilic next and the cationic blocks on the outside. In solution, these string form in small clusters called micelles, again with the hydrophobic blocks at the center.

Surya Mallapragada is working to understand how special block polymers are able to "self-assemble" due to changes in pH and temperature. The polymers react similar to proteins in nature but are more robust, allowing them to be manipulated in different ways.

Temperature and pH Sensitive

"The interesting thing about these polymers is that they respond to changes in temperature and pH," Mallapragada says. "As the temperature goes up, the micelles cluster together more, forming a polymer gel. A similar reaction takes place as pH rises, the hydrophobicity of the cationic blocks increase which also helps in gel formation."

As temperature and/or pH drops, the process reverses itself and the gels dissolve back into micelles and polymer strands. Using cryotransmission electron microscopy, Mallapragada's group is working to understand just how these micelles look and how fast the polymers respond to changes in temperature and pH.

"Samples are plunged into liquid ethane which freezes them so quickly that ice doesn't form and disrupt the crystal structure," she says. "We're able to then view the gel formation at various stages (temperature and pH) under very controlled conditions." She adds that this work will be complemented by conducting X-ray scattering studies at the Advanced Photon Source facility at the U.S. Department of Energy's Argonne National Laboratory.

Selective Delivery

The polymers show promise as a way to deliver drugs or gene therapies. For example, incorporating the glucose oxidase enzyme in the polymer would make it sensitive to glucose levels in the body. Insulin, incorporated in the polymer, could be injected into the body and released when the gluconic acid level falls and the polymer dissolves.

For potential gene therapies, the positively charged (cationic blocks) polymers can complex with DNA (negatively charged). The polymers could be used to deliver so-called suicide genes and chemotherapy drugs directly and selectively to tumors, since normal cells would be less likely to react with the polymer and express the incorporated gene.

A preliminary invivo study in rats is now underway in conjunction with the John Stoddard Cancer Center at Iowa Methodist Medical Center in Des Moines.

The basic research on polymer synthesis and characterization is funded by the Materials Chemistry program within the DOE's Office of Science. The gene therapy and bioapplication work is funded by a Bailey Career Development Grant.

Keeping the Air Force in the Air

The Center for Nondestructive Evaluation applies its wealth of knowledge to keep Air Force aircraft safe and ready to fly.

IPRT's Center for Nondestructive Evaluation was founded in 1985 to develop and transition inspection technologies to industrial users. A strong component of the program has always been to keep our nation's commercial aircraft safe, greatly expanding the science of inspecting aircraft and critical components without destroying them. The world-renowned center has gone on to leverage this expertise for many different parts of the aerospace industry and for other industries such as nuclear energy, automotive and materials manufacturing.

Now, with a grant from the Air Force Research Laboratory, CNDE is applying its knowledge and years of experience to help keep Air Force aircraft in top shape. The center is studying how a gamut of nondestructive evaluation technologies can be improved and applied to the Air Force's aging fleet. Indeed, the effort could become a long-term project.

"It's part of a national response to increased need for military readiness," explains R. Bruce Thompson, CNDE director and a distinguished professor of engineering at Iowa State University. "The ultimate benefit to the Air Force is to have a fleet of aircraft that are available for use a large percentage of the time and that will perform reliably at a minimum cost."

IPRT's Center for Nondestructive Evaluation is using its experience and expertise to keep the Air Force's aging fleet in flying condition. ***(F-16 "Viper" photo courtesy of Rob Maroc, Des Moines Iowa Air National Guard)***

A Strong Edge

CNDE was a natural fit for the project, according to Thompson. "Our edge is our strong knowledge and an experienced staff," he says, noting that the center's past and current work with the Federal Aviation Administration and NASA also played a part. "We have a whole bank of techniques, capabilities and ideas that can be drawn upon." Moreover, CNDE has vast experience in getting the technology out to the field where it can have an impact. Indeed, the center has worked with dozens of industrial companies to deploy NDE technology since its founding.

Thompson sees the research for the FAA and NASA as complimentary to that being done with the Air Force. "They have similar, sometimes complimentary problems," Thompson says. He adds, however, that the Air Force tasks will be different in detail from what's being done for commercial aviation.

The researchers are now working with the Air Force to review over 20 different NDE technologies to see which are the best candidates for solving the Air Force's inspection problems. The majority of the work will be done at ISU with some projects performed at other universities and industry when unique capabilities exist.

One focus of the effort will be to extend the life of critical components such as jet engines. Some of these parts can cost tens of thousands of dollars. "Clearly, if you don't have to throw away a $20,000 part before its useful life is extended, that's significant cost savings," Thompson says.

For example, Thompson explains that jet engine components such as turbine blades are strengthened with a process called shot peening. Here, small beads are shot at the part during fabrication, which builds in residual stresses that impede the growth of cracks. Over time, however, the high temperatures and stresses of jet engine operation may cause this residual stress protection to diminish. "You need to be able to measure that stress to know how much of the life the component remains," Thompson says. Existing methods for measuring residual stress only measure stress in a very thin layer near the surface of a component. So, part of CNDE's research is looking at developing improved techniques to measure the stress at a considerably greater depth comparable to the depth of the shot-peened region.

Simulation for a Fast Response

The CNDE program for the Air Force will also include the study of simulation techniques for nondestructive evaluation, that is, using a computer to simulate how to best inspect for a defect. "Simulation allows you to have a rational basis for designing new inspections when a new problem presents itself," explains Thompson. "Simulations provide a much faster way to respond to problems." Also, simulations can help assess how well a technique might work. "No technique is perfect, so you always miss some defects, but you want the number you miss to be sufficiently low," Thompson says. CNDE will apply its vast experience in creating computer-based NDE simulation tools to the program.

The effort is a large one, according to Lisa Brasche, associate director of CNDE and a leader on CNDE's Air Force project. "Over the course of the program, I would expect that 15 to 20 CNDE investigators will be involved," she says, adding that the project will also support 10 to 15 graduate and post-doctoral students.

Forensics Focus on Toolmarks

Research at IPRT's Midwest Forensics Resource Center aims to develop a more scientific method of matching hand tools to crimes, helping to nab the criminals that use them.

During the manufacturing process and through normal use, hand tools such as screwdrivers, pliers and wire cutters are left with marks or imperfections embedded on their surfaces. These patterns are believed to make each tool unique. When tools are used to perpetrate a crime, such as jimmying a door, the patterns on the tools are transferred to the crime scene.

Stan Bajic, an Ames Laboratory scientist, studies an image of a toolmark embedded into the surface of an ordinary pair of pliers.

At this time, however, there is no concrete evidence to prove that tools and their marks are unique based on certain manufacturing processes, say both Stan Bajic, Ames Laboratory associate scientist, and David Baldwin, director of IPRT's Midwest Forensics Resources Center. As a result, such evidence may be challenged in court. But that may change, thanks to two research projects underway at the MFRC, which works with crime laboratory officials from across the Midwest.

13,000 Toolmark Images

One of the projects is headed by Bajic and Baldwin. The first part involves building a database of toolmark images. The database consists of digital images of the striations on tool surfaces produced by six different manufacturing processes. The database is the first to incorporate numerous manufacturing methods and so many samples.

Bajic says building the database requires production of multiple images through the use of a forensic comparison microscope. The number of images required for the project quickly grew to more than 1,000 images per set of tools, and Bajic says that in the end, the researchers will have produced some 13,000 images.

In the project's second phase, the images were used to produce a software tool for the reduction and analysis of the image data. Algorithms were developed and used for the comparison of the various toolmarks. Creation of the software is led by Max Morris, an ISU professor in statistics and industrial engineering and an Ames Laboratory associate.

The algorithm can mimic the behavior of forensic examiners. But, Morris is quick to point out that it will never replace what they do because there are subtleties in what real toolmark examiners do. "We're hoping to be able to do a separation of the obvious stuff very quickly so that the toolmark examiner can focus his energy on the more complicated cases to call," he adds.

Ultimately, Bajic hopes the research will culminate in the statistical tools necessary for validation of the proposition that particular manufacturing methods produce marks on tools that are substantially different from tool to tool. "In the end, what we will be trying to say, for example, is that the chances of this screwdriver having the same marks as another from the hardware store are one in 10,000 or some number," Bajic says.

Into the Third Dimension

Moving from a two-dimensional to three-dimensional look at toolmarks is the goal of a second MFRC project led by Scott Chumbley, an Ames Laboratory metallurgist and an ISU professor of materials science and engineering. He and co-principal investigator Larry Genalo are using 3-D characterization methods and statistical methods to identify toolmarks. Their research involves using a profilometer, a scanning tool that measures the height or depth of toolmarks and then develops a type of contour map of the marks from the scan. This map can then be used to precisely identify a toolmark, allowing forensic specialists to match the mark on the tool to marks made by the tool at the crime scene.

Like Bajic's work, this scientifically tested technique may also one day address the needs of the court system for providing quantifiable scientific data with known measures of reliability. Preliminary results show the reproducibility of the instrument is better than 99.9 percent on known samples.

Delivering on the Biomass Promise

IPRT centers lead the way in biomass research to make new uses for Iowa's agricultural crops and reduce our nation's dependence on foreign oil.

Two IPRT research centers are leading the charge to investigate new ways to leverage "biomass," organic material such as crops and crop wastes. The Center for Sustainable Environmental Technologies and the Center for Catalysis recently received funding for biomass research projects from a new joint grant program between the U.S. Department of Agriculture and U.S. Department of Energy. Another group of ISU researchers are partners in a third project. Only 19 projects out of 400 applications were selected for funding.

"This is a big win for the state of Iowa and ISU," says Robert Brown, CSET director. "Not only can the use of biomass decrease our nation's dependence on foreign sources of petroleum, it also has great potential to boost Iowa's economy by developing value-added products from Iowa's most important resource: agricultural crops," explains Brown, who is also the ISU Bergles professor of mechanical engineering, a professor of chemical engineering and director of ISU's Office of Biorenewables Programs. "These awards also confirm ISU's leadership in developing biobased products."

Biopolymers from Byproducts

CSET received $1 million from the USDA Natural Resources Conservation Service to research production of biopolymers from distillers' dried grains, a byproduct in the production of ethanol from corn. "Development of value-added products from these grains will be critical to the future profitability of the corn ethanol industry," Brown says.

This research team will investigate a different, three-step process that they hope will prove to be more cost effective. First, high-value compounds such as proteins and carbohydrates will be extracted from the grains. The remaining residue is then gasified into carbon monoxide and hydrogen. Lastly, the carbon monoxide is fermented to create a class of polymers known as polyhydroxyalkonates, or PHAs, polyesters that have potential applications in the manufacture of biobased plastics, synthetic fibers and films.

Partners in the project include South Dakota State University and Midwest Grain Processors, Lakota, Iowa, one of the largest farmer-owned ethanol plants in the country. The project builds on research supported by the Biorenewable Resources Consortium at ISU and the Iowa Energy Center.

Soy Diesel Made Easier

In another project, IPRT's Center for Catalysis is a partner with West Central Cooperative of Ralston, Iowa, in a $1.2 million award to study new technologies for production of methyl ester from soybeans. This "soy diesel" is gaining favor as an alternative fuel and a more environmentally friendly industrial solvent. This project was initiated by a grant from CCAT and the Biorenewables Resources Consortium.

"Our new technology has the potential to reduce energy consumption, enhance economic competitiveness and lower the environmental impact of methyl ester production," says George Kraus, director of CCAT and a professor of chemistry at ISU.

The current process to convert soy oil into soy diesel, which relies on the use of homogeneous catalysts, is energy-and labor-intensive. ISU scientists have developed a more efficient method based on "mesoporous silica nanocatalysts," honeycombed particles that speed up the conversion process and which can be more easily separated and recycled after they've done their job.

The ISU researchers will team with West Central Cooperative, a farmer-owned cooperative that annually processes 2.2 million pounds of soy oil into methyl esters, to scale up production of test catalysts, analyze tests and design equipment to mass produce new catalysts.

ISU's Office of Biorenewables Programs supports and promotes development of the nation's bioeconomy, using crops and plant materials to produce biobased products. In addition to CSET, collaborating units at ISU include the Center for Crops Utilization Research, the Center for Designer Crops and the Center for Industrial Research and Service. Another collaborator, the Biorenewable Resources Consortium, is a partnership between the DOE's Ames Laboratory at ISU, the Iowa Agriculture and Home Economics Experiment Station, which is administered by Iowa State's College of Agriculture, and ISU's Plant Sciences Institute.

Distiller's dried grain, a byproduct of corn ethanol production, is piled up at Midwest Grain Processors in Lakota, Iowa. Turning this material into useful polymers is one focus of IPRT's biomass research efforts.

Virtual Reality to Go

The Virtual Reality Applications Center brings VR into the mainstream with a portable, low-cost VR theater.

A new low-cost, portable virtual reality system demonstrates how virtual reality can be brought into the mainstream of computing. It was designed and built by Carolina Cruz-Neira and her research team from IPRT's Virtual Reality Applications Center.

"We designed it to provide the best quality image possible at the lowest cost," said Cruz-Neira, associate director of VRAC and an associate professor of industrial and manufacturing systems engineering at Iowa State University. The system uses standard personal computers, meeting-room video projectors and other off-the-shelf components. The effort to design and build the system was supported by Procter & Gamble, a long-time VRAC research partner.

Like Building Blocks

The system consists of a number of self-contained display modules. These wedge-shaped aluminum structures hold an 8-foot-wide by 6-foot-tall, snap-on screen at the wide end and two computers and two projectors at the narrow end. The modules are on wheels to easily move and reconfigure the system. Using four modules, the system can be made into a room-like, immersive system with four walls or an ultrawide 32-foot-long display.

To keep costs down, the system uses polarized light and inexpensive polarized glasses to achieve the stereoscopic, 3-D images required for VR. For sound, it uses an audio system and speakers like those found in most desktop personal computers. The system can be set up in about two hours and does not require high ceilings. The pieces of the system simply lock together like building blocks. VR Juggler, an open-source software environment created by VRAC, allows the system to run a variety of VR applications.

IPRT's Virtual Reality Applications Center designed and built a portable, low-cost VR system, bringing the technology to a new set of users and applications.

On the Move

To show the capabilities of its portable VR system, Cruz-Neira is literally taking it around the world. In February 2004, Cruz-Neira and a group of her talented students took the system to Spain, where it was the center of attention at a major computer trade show. VRAC also featured the system at the SIGGRAPH 2003 show in San Diego and the Supercomputer 2002 show in Baltimore.

VRAC often uses two unique applications to demonstrate the system's capabilities. One is a re-creation of a Hindu ritual, while the other is an artistic "immersive sound scape" based on the recollections of World Trade Center witnesses and survivors.

The Hindu ritual simulation, designed as a tool for education about religious and cultural traditions, presents the story of a Hindu devotional ritual in a temple, complete with worshippers, priests and music. It was initially seeded by a Miller Fellowship awarded to Whitney Sanford, an associate professor of philosophy and religion at ISU and a teacher of world religion, and to Cruz-Neira.

"Some of the impetus for this project came because I'd like to take my students to certain places in India, but can't," Sanford says. "With this technology, I can immerse students in a temple and ritual and teach them about ritual as performance, use of space, sacred architecture, iconography and so on. I can teach better by taking students somewhere than by standing in front of them lecturing."

Ashes to Ashes/Dance Driving is a new art form that combines music, dance and virtual reality to create a healing experience based on a traumatic historical event — the terrorist attacks of Sept. 11 — in order to show the resilience of the human spirit. The work is a collaboration between VRAC's Cruz-Neira; Anne Deane, assistant professor of music at ISU; Valerie Williams, director of the Co'Motion Dance Theater, Ames, Iowa; and other experts and students. It was funded through grants from an ISU Special Research Initiative Grant and the Iowa Council for the Arts.

The project deploys an interactive, immersive, sonic, dance and computer animation environment in which participants can choose which specific subject matters to pursue as they interact with the recollections of fire fighters, relief workers, survivors and onlookers to the attacks on the World Trade Center.

Enhancing Education

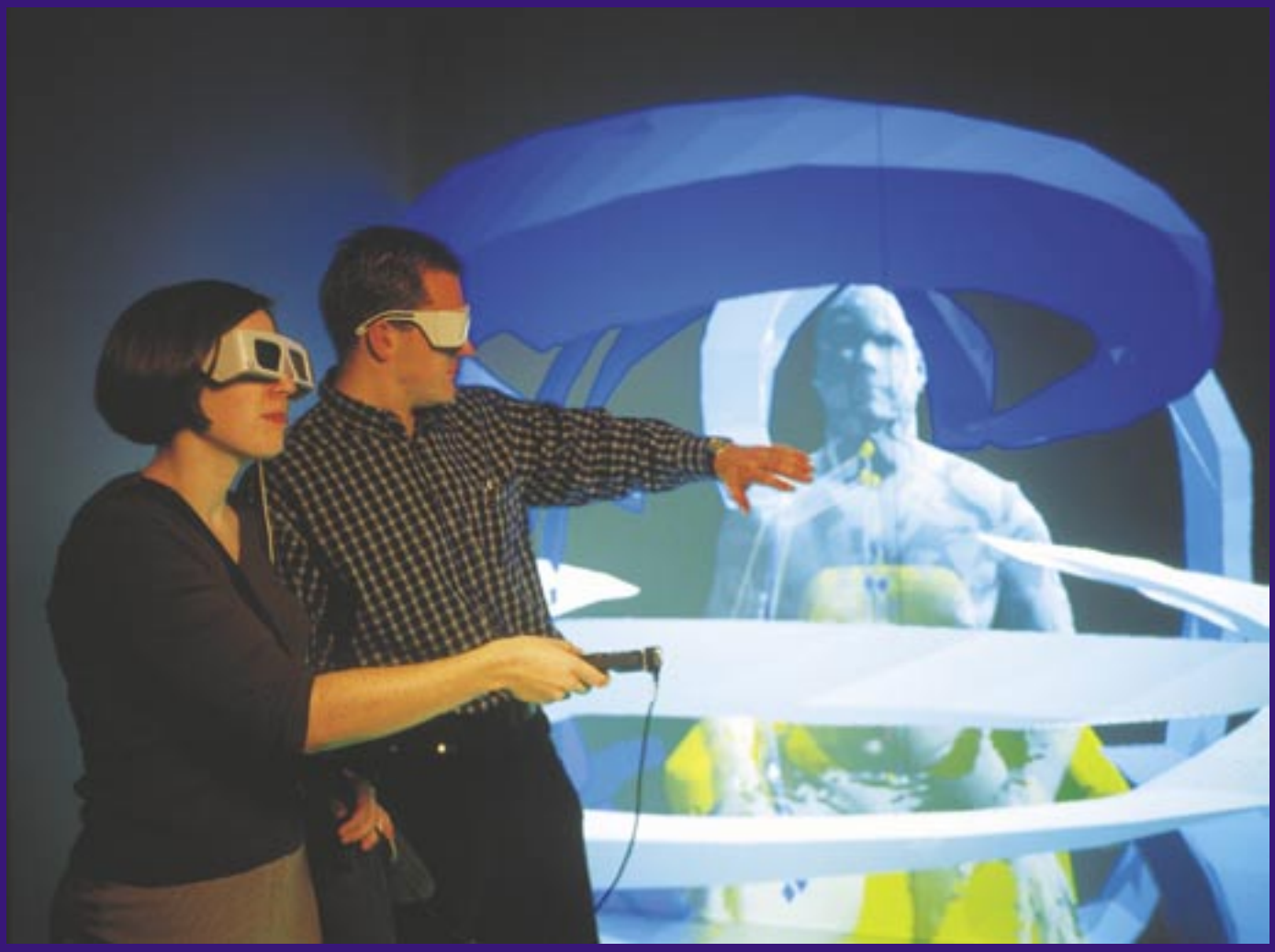


Photo: ISU Engineering Communications and Marketing

Melinda Cerney was recently awarded a National Science Foundation Graduate Research Fellowship, which supports outstanding graduate students throughout the country. The award will help fund Cerney's continued studies at Iowa State University and IPRT's Virtual Reality Applications Center. While an undergraduate, Cerney began working with Judy Vance, Professor and Chair of Mechanical Engineering and a VRAC Research Associate. Cerney's research focuses on visualization and analysis of human figure data, a critical arm of virtual reality and a key to improving product designs to make them more comfortably accommodate people of all shapes and sizes. Providing students with a world-class research experience is one way IPRT fulfills its education mission.

Science Bound Makes a Difference

IPRT's Science Bound is an educational program aimed at increasing the number of underrepresented students of color in science and math careers. In partnership with the Des Moines Public Schools, the program helps students in grades 8-12 develop skills and interest in science and math. Students that stay in Science Bound receive a full-tuition scholarship to ISU if they enroll in a technical degree program.

Science Bound provides science and math-related activities, held after school and on Saturdays, to complement the regular school curriculum. To stay in the program, students must maintain a specific grade point average in addition to participating in Science Bound activities.

In 2002-2003, five graduates from Science Bound received diplomas from ISU, bringing the total number of Science Bound/ISU graduates to 16. The newest round of graduates represent degrees in biology, management information services, psychology, and transportation and logistics. In spite of budgetary challenges, Science Bound served more that 220 students and families in the Des Moines area during the last year. Sixteen students graduated from the program, 12 of which indicated their intent to attend ISU. In 2003, there were 47 Science Bound graduates at ISU with 34 pursuing technical careers.

In October 2003, students from Science Bound joined millions of Americans across the country on the 11th Make A Difference Day — but with a twist. "I wanted our students to learn how they can make a difference through science and math," explains Anita Rollins, Science Bound program coordinator. The students' usual Saturday visit to the ISU campus transformed into an environmental learning and service experience. "Some students helped clean up a lake, while others heard about tools used by environmental scientists or learned about environmental issues in bridge building and in factories," Rollins says.

In addition to funding from ISU and IPRT, Science Bound is made possible by donations from industry sponsors. Recently, Cargill became a sponsor of Science Bound Saturdays. "We are very pleased to have Cargill's support," Rollins says. "Our Saturday classes are the cornerstone to helping Science Bound students learn more about science and math and help them prepare for college."

Students in IPRT's Science Bound program come to workshops at Iowa State University to deepen their knowledge of science and mathematics.

High Schoolers Leap into Science Bowl

In 2003, 44 Iowa high schools buzzed into the Ames Laboratory/Iowa State University 2003 regional Science Bowl, held January 25 in Ames. The Ames Lab/ISU event is one of more than 60 regional competitions held throughout the nation. Science Bowl, first held in 1991, has the goal of encouraging high school students to excel in science and math and to pursue careers in those fields.

Ames Lab and ISU have participated in all 13 competitions. The event consists of teams of up to five students in a fast-paced, daylong competition to answer a broad range of science and math questions. Faculty, staff members and students from Ames Laboratory, IPRT and ISU served as moderators, judges, timekeepers and scorekeepers. Cedar Rapids Washington High School emerged as the winner and competed in the U.S. Department of Energy National Science Bowl in Washington, D.C.

In 2004, Ames Lab will host the inaugural Department of Energy National Middle School Science Bowl regional competition. "The middle school event provides an exciting opportunity for the Lab to reach out to a whole new level of students and provide them with a competitive opportunity in which to demonstrate their math and science skills," says Steve Karsjen, Science Bowl coordinator.

Science Bowl 2004

Unlike the high school Science Bowl, however, the middle school version will be a two-day affair. On the first day, student teams will participate in competition to build hydrogen fuel-cell cars. On the second day, the teams will compete in the academic contest.

High school students from around Iowa compete in the annual Ames Laboratory/Iowa State University Science Bowl.

Safir Moizuddin, an employee of MicroSoy Corp. in Jefferson, Iowa, began working with the company as an Iowa State University student on an IPRT-sponsored research project.

Research Project Turns into New Career

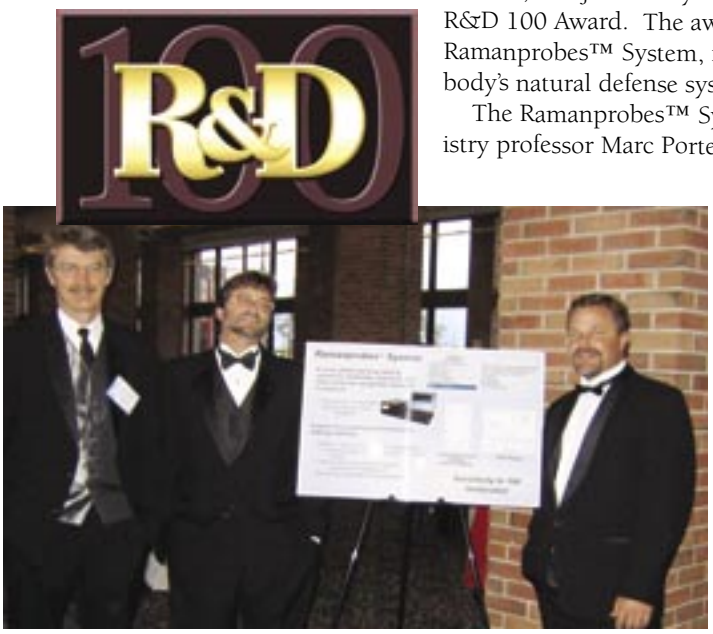
Many IPRT projects involve Iowa State University students, providing a real-world problem on which to work and learn from. And from time to time, some of these students go on to work for the company after graduating. Everyone wins. The company gets an employee they already know and that knows them, the student gets a sure start on a promising career, and Iowa keeps one more educated young person in the state.

Take the case of Safir Moizuddin, who as an ISU student worked with MicroSoy Corp., a soy-processing company headquartered in Jefferson, Iowa. On a research project funded by MicroSoy, IPRT and ISU, Moizuddin helped the company better understand the processing for soymilk and tofu using a specialized cooking system and MicroSoy Flakes. This product — essentially a dehulled soybean that has been dried, cracked, rolled and enclosed in an airtight package — is said to have many benefits over raw soybeans.

In the research project, Moizuddin worked with Lester Wilson, a professor of food science and human nutrition at ISU. The researchers tested cooking times and temperatures and evaluated flavor. The study's results were used to enhance sales of MicroSoy Flakes to soymilk and tofu producers. Moizuddin, who earned his B.S. and M.S. degrees from ISU, was subsequently hired by the company as a full-time employee in August 2003.

Moizuddin is now playing a key role in helping MicroSoy's customers and potential customers use MicroSoy Flakes as an ingredient in other food products such as breakfast bars, according to Terry Tanaka, company president and CEO. Moizuddin is glad for the opportunity. "The future looks pretty bright for MicroSoy Corp.," he says.

IPRT Researchers Win R&D Award



Robert Lipert (left) and Marc Porter (center) of IPRT and Iowa State University garnered a 2003 R&D 100 Award with their partner, Christian Shoen (right), of Concurrent Analytical, Inc.

IPRT, in a joint entry with Concurrent Analytical, Inc., Kailua, Hawaii, won a 2003 R&D 100 Award. The award was given for a new-generation immunoassay system, the Ramanprobes™ System, for detecting and labeling antigens — proteins that serve as the body's natural defense system against infectious agents.

The Ramanprobes™ System was developed jointly by Iowa State University chemistry professor Marc Porter and associate scientist Bob Lipert of IPRT; and by Christian Schoen, president of Concurrent Analytical, Inc. Sponsored by R&D Magazine, the R&D 100 Awards honor the top 100 products of technological significance marketed or licensed during the previous calendar year. The Chicago Tribune has called the R&D 100 Awards, the only awards for applied science and scientists, the "Oscars of applied science."

Potential applications for Ramanprobes™ lie in the medical and military arenas. In the medical field, the instrument can be used for toxicology and infectious disease applications. Where antibodies exist for the target molecule, the use of Ramanprobes™ will allow for quick detection and identification of many emergency medical applications, including HIV and Hepatitis C, smallpox, botulism, tularemia and the plague.

New VRAC Director Named

James Oliver has been appointed director of IPRT's Virtual Reality Applications Center. Oliver's appointment became effective Jan. 1, 2004. Oliver will replace James Bernard, holder of an Anson Marston Distinguished Professorship in engineering, who is stepping down after 13 years as VRAC director. "It would be impossible to overstate the contributions of Jim Bernard in bringing VRAC to a position of leadership in the international world of virtual reality research," says Tom Barton, IPRT director.

"In addition to his outstanding background in software development, Jim brings a valuable understanding of the needs of industry to an organization that strongly promotes industry interactions," says Barton. "His appointment will provide VRAC with the strong leadership necessary for the center to grow as opportunities for application of virtual reality and other advanced computer technologies continue to expand."

Oliver is an associate professor of mechanical engineering at ISU. He is also chair of the newly established graduate program in human computer interaction, or HCI, and his research focuses on HCI applications in engineering. Prior to that, he held numerous positions in both the private and public sectors.

Jim Oliver is the new director of IPRT's Virtual Reality Applications Center, which is involved in approximately $10 million in ongoing contract research with companies such as Deere & Company.

Advisory Board Steers IPRT

The IPRT Industrial Advisory Board — chartered to provide IPRT advice in formulating mid- to long-term research plans and directions — has marked its four-year anniversary.

John "Jack" Harris, a charter member and current chair of the IAB, explains that the IAB has developed a genuine appreciation for IPRT's "uniqueness" within the university setting. Harris says he knows of no other university that has an entity that fosters interdisciplinary research as successfully as IPRT. "It's when you bring many disciplines together that you make progress," says Harris.

Harris points to progress on many fronts when he talks about the IAB's efforts on behalf of IPRT. At each IAB meeting, members interact with IPRT centers through tours and talks with center scientists and students. Harris says his company in particular has had positive interactions with the Center for Nondestructive Evaluation, which he says has led United Technologies/Pratt & Whitney to become a full supporter of IPRT. "Many of the companies represented on the IAB are now sponsoring research and recruiting graduates at ISU," adds Harris, who also points to the recently formed combinatorial chemistry initiative at ISU as a board success. He says the concept for this initiative came directly from board members.

IAB members have science, technology and business backgrounds and represent many diverse disciplines in Fortune 500 and other companies around the nation. IAB companies include ALCOA, Inc.; General Mills; Deere & Company; General Motors Co.; Dow Corning Corp.; Ernst & Young; Micron Technology, Inc.; Rockwell Scientific; Delta Air Lines, Inc.; The Boeing Co.; The Gillette Co.; The Goodyear Tire & Rubber Co.; and United Technologies/Pratt & Whitney.

Harris says IAB members are helping IPRT develop a roadmap for the future. During each IAB meeting, members participate in a "Beyond the Headlights" segment in which they discuss things that could impact industry in the next 10 years. Harris says this time frame is important because of today's pressure to bring products to market, which results in industry's research focus usually being no farther out than three years. He says he expects to see industry turning more and more to universities and organizations such as IPRT to provide the basic research it no longer conducts in house. "The IAB can make an impact in this area by helping IPRT bring focus to the key research areas in which industry has needs," says Harris.

The IAB will next discuss IPRT's strategic planning activities. Harris says he believes this plan will ultimately help IPRT determine where it wants to go in the 5-10 year time frame. And once it knows, he says the IAB "will help it get there."

John "Jack" Harris is the chair of the IPRT Industrial Advisory Board, which provides IPRT advice in setting research plans and directions.

Interactions
FY 2002-2003

The Institute for Physical research and technology assisted over 278 organizations in 103 cities, towns, covering 66 Iowa counties. This assistance ranges from initial contact and referral to full research.

Adair
Schafer Systems, Inc.
Adel
Inland Coatings Corporation
Thermal Dynamics Agency
Bonser's Pasta Products
Albia
Albia Police Department
Ames
Acumen Instruments
Advanced Analytical Technologies, Inc.
Apogee Corporation
Atanasoft
BioForce Nanosciences, Inc.
Bright Engineering, Inc.
Combisep, Inc.
Edge Technologies, Inc.
EDS
Ensoft Corporation
ETREMA Products, Inc.
Fox Engineering
Global VetLink
Innovative Materials Testing Technologies, Inc.
Integrated Sensor Technologies, Inc.
Lanka Technologies
M G Biologics, Inc.
Mary Greeley Medical Center
Metabolic Technologies
Molecular Express, Inc.
MSTRS Technologies, Inc.
NDE Technologies, Inc.
New Monics, Inc.
NewLink Genetics
NovaScan Technologies
Pacing Technologies, Inc.
Palisade Systems, Inc.
Phytodyne, Inc.
Prairie Logic
ProPlanner.net
RegenaCorp, Inc.
Rocket Chips, Inc.
Sauer Danfoss Company
Sukra Helitek, Inc.
United States Filter Corporation
Veterinary Resources, Inc.
Anamosa
Chem-ECO Environmental
Thomas Enterprises
Ankeny
Bull Hides Coating of Iowa
Integrated Environmental Systems
John Deere, Des Moines Works

Belmond
Eaton Corporation

Bettendorf
Biostar
Schebler Company
Simpaldezine
Yankee Plastic Company
Boone
Boone Scenic Valley Railroad
Iowa Army National Guard
Iowa Thin Film Technologies, Inc.
Midland Bio-Products Corporation
Nisus Technologies
Brooklyn
Creative Composites, Inc.
Burlington
Winegard Corporation

Cambridge
Swine Genetics
Carroll
Agren, Inc.
Cedar Falls
ACRES Research
Newcor
TestAmerica, Inc.
Cedar Rapids
Alliant Energy Corporation
Amtek
Casco International
Computing Solutions, Inc.
Diamond V Mills
Genencor International, Inc.
Gyco, Inc.
Lightwaves Systems, Inc.
Mitec, Inc.
Panamat
Phoenix Engineering International
Polar Promotions
QualityCareSystems.Com, Inc.
Raining Rose, Inc.
Rockwell Collins, Inc.
Soywax
Square D Company
Titan Holdings Company
Tucker Manufacturing Company, Inc.
Centerville
H & S Auto Shot, Inc.
Knight Rifle (Modern Muzzle loaders)
PR Lind
Prairie Lands Bio Products
Charles City
Diversified Fastening Systems
Clear Lake
Kingland Systems
Team Quest Corporation

Clinton
Lamson & Sessions
Conrad
Ritchie Industries
Coralville
Dunwoody Technologies, Inc.
Oakdale Systems, Inc.
Patient Education Institute, Inc.
Corydon
Shivvers Manufacturing, Inc.
Council Bluffs
Automated Concepts, Inc.
Mastercraft
Cresco
Featherlite, Inc.
Creston
Gits Manufacturing

Dakota City
IBP
Dallas Center
Hy-Vac, Inc.
Intervet, Inc.
Davenport
Aerospace Control Products, Inc.
ALCOA
Blue Wave Ultrasonics
Genesis Systems
Warren Packaging Corporation
Denison
Denison Engineering Corporation
Des Moines
Adhesive Compounders, Inc.
Advanced Animal Therapeutics, Inc.
Bureau of Alcohol, Tobacco, Firearms, and Explosives
C & K Printing, Inc.
Chem-Tech Ltd.
Consumer Safety Technology
Crumps Magna Designs
Diamond Animal Health, Inc.
Empire Stone
Feed Energy Company
Howard R Green Company
Iowa Air National Guard
Iowa Attorney General's Office
Iowa Criminalistics Laboratory
Iowa Department of Public Defense
Iowa Soybean Promotion Board
Net Zero Buildings
Principal Financial Group
R A D, Inc.
Rowe Electronics
Sciengistics
State of Iowa, Dept. of Public Safety
Townsend Engineering
US Auto Acceptance, Inc.
Viable Technologies
Dickens
Nolin Milling, Inc.
Dubuque
Eagle Point Software, Inc.
Inland Protein Company
John Deere Dubuque Works
Dyersville
Dyersville Police Department
Lumber Specialties

Eddyville
Ajinomoto
Cargill, Inc.
Heartland Lysine
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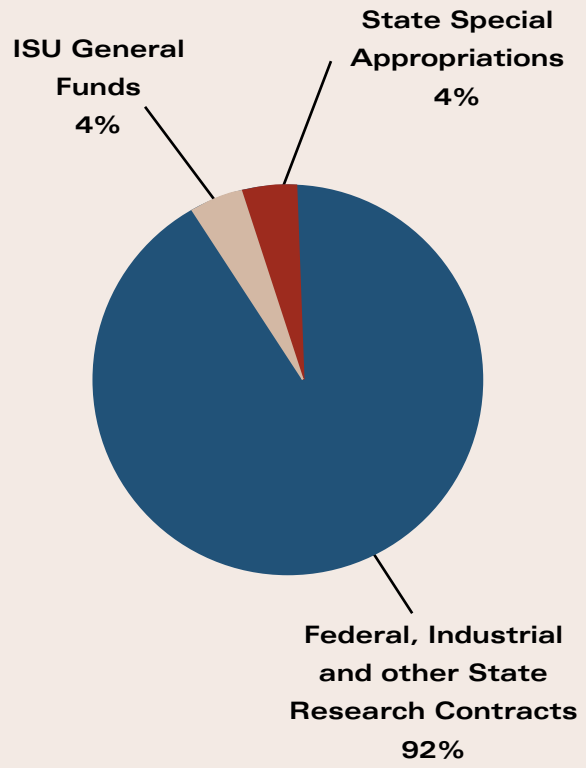

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